# Airborne Digital Imaging for Spill Prevention & Response

Paul Veisze
California Department of Fish and Game
Research Manager (GIS)
Sacramento

# Overview
# Applications : Technologies

- **Kelp Mapping** : Digital Multi-Spectral Video

- **Incident Response** : Digital-Still Imaging
- **Code Enforcement** :

- **Response Planning**: Video/GPS Recon

# Previous Work

- DFG Air Services aerial photography (ca. 1950's – 1980's)
- Digitization of Aerial Photography (Kelp Surveys, 1989 EcoScan, 1999 DFG)
- Federal/State Efforts
- NASA/CDF (Wildland Fire/RealTime Data)
- USDI/MMS – Environment Canada (Laser Fluorospectometry)


Fish and Game --  Partenavia P6 -- Recon Aircraft

California bases: Sacramento, Hemet, Fresno, Redding

- **Kelp Mapping** : Digital Multi-Spectral Video

- **Incident Response :** Digital-Still Imaging with GPS Integration

  Georeferencing

- **Code Enforcement :** Change Detection

- **Response Planning**: Video / GPS Recon

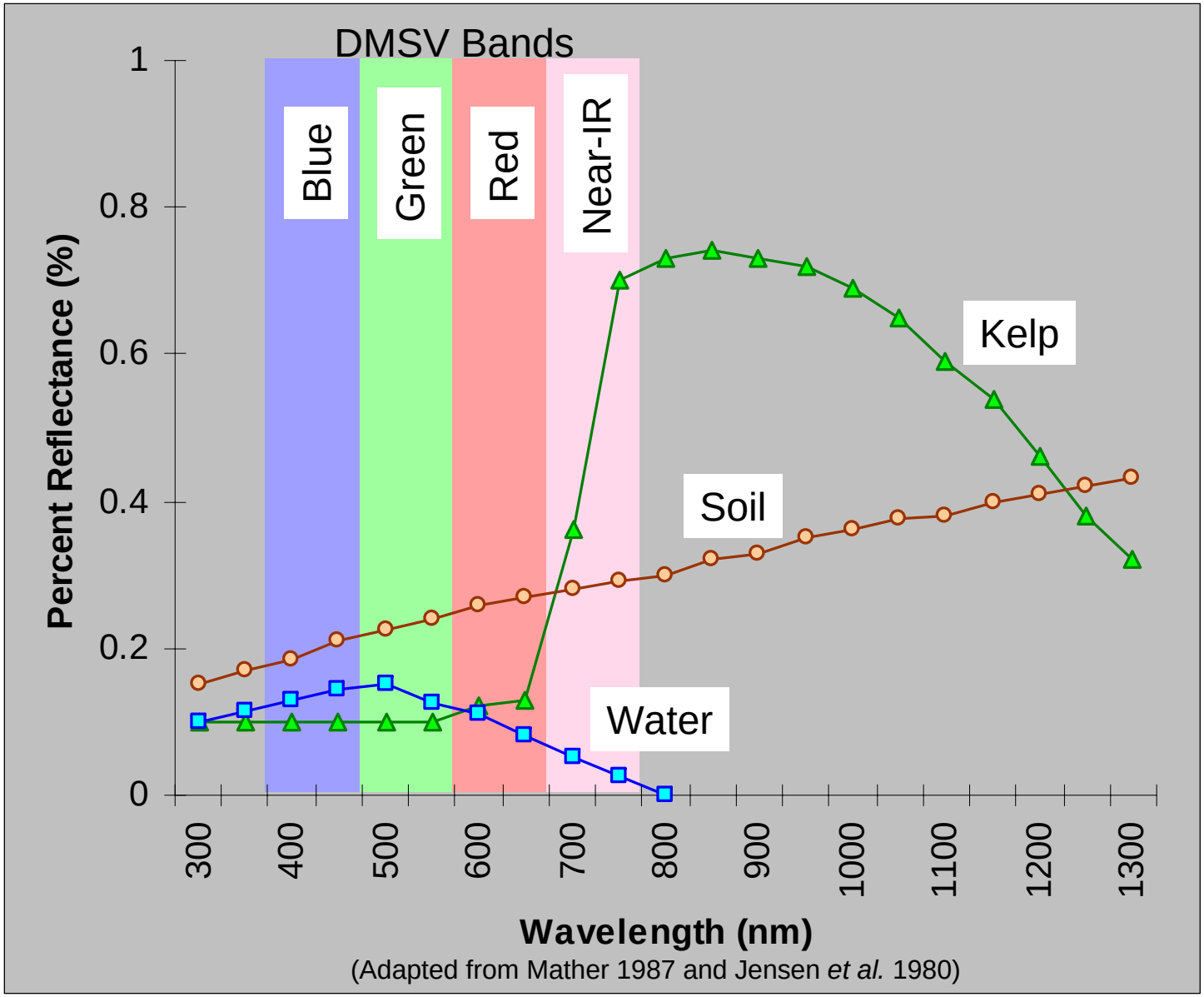
# Digital Multi-Spectral Video

- DMSV: 4 – band color
  Blue : 450 nm
  Green : 550
  Red : 650
  Near-IR : 750

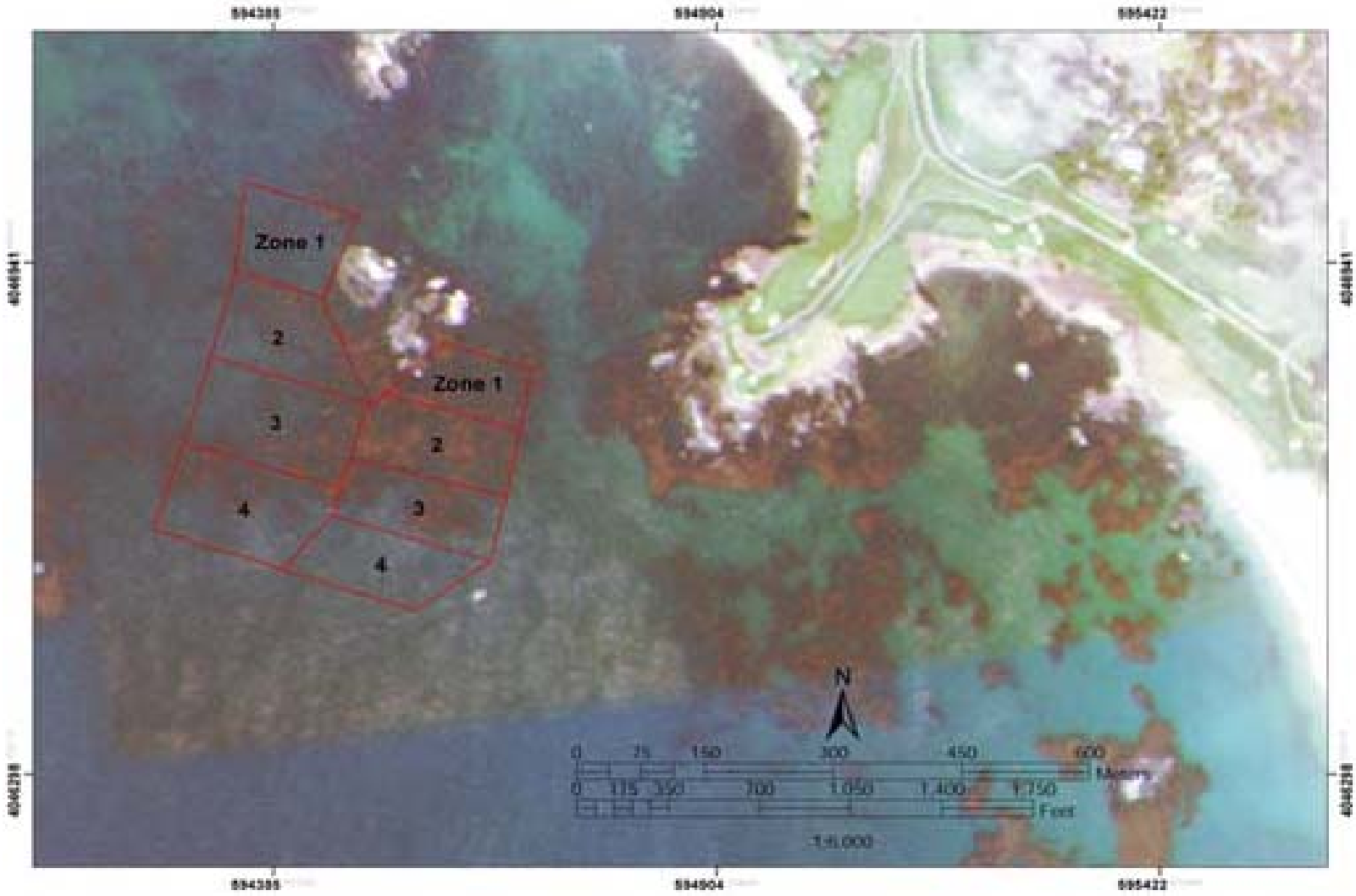
- CCD : 740 x 578

- 2m Pixel @ 11,000 ft.

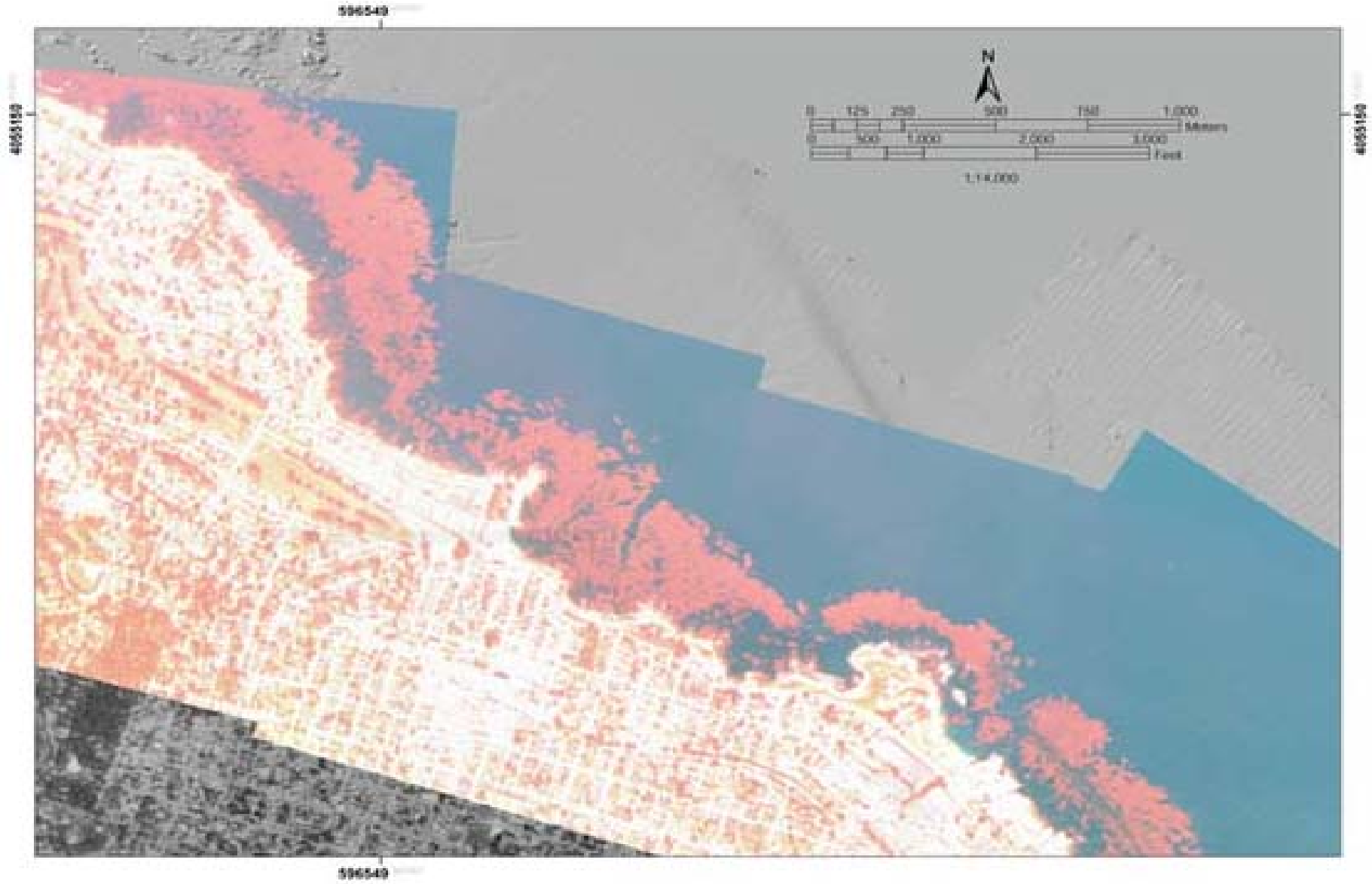
# Spectral Reflectance Characteristics of Kelp (*Macrocystis pyrifera*), Water, and Soil



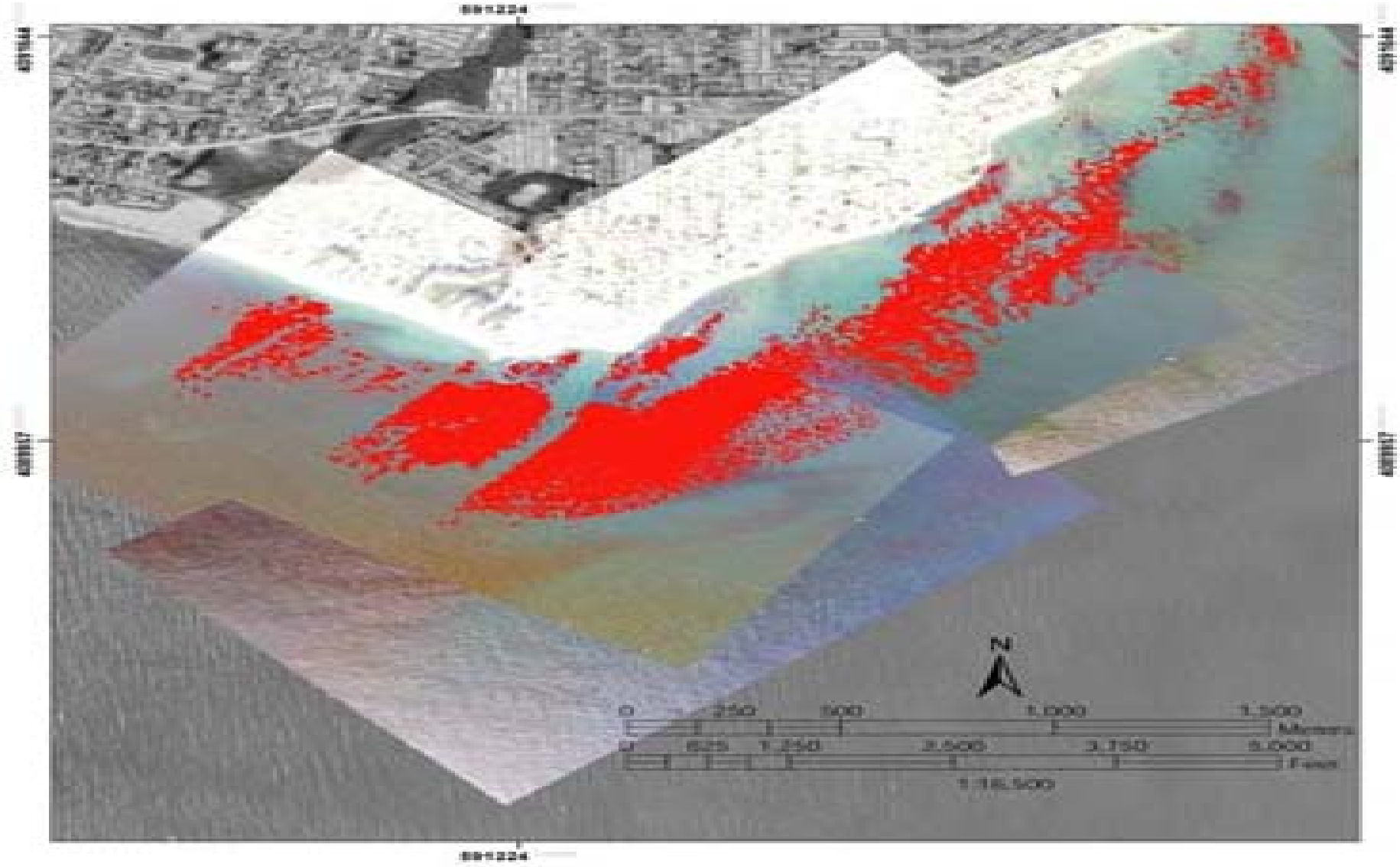

(Adapted from Mather 1987 and Jensen *et al.* 1980)



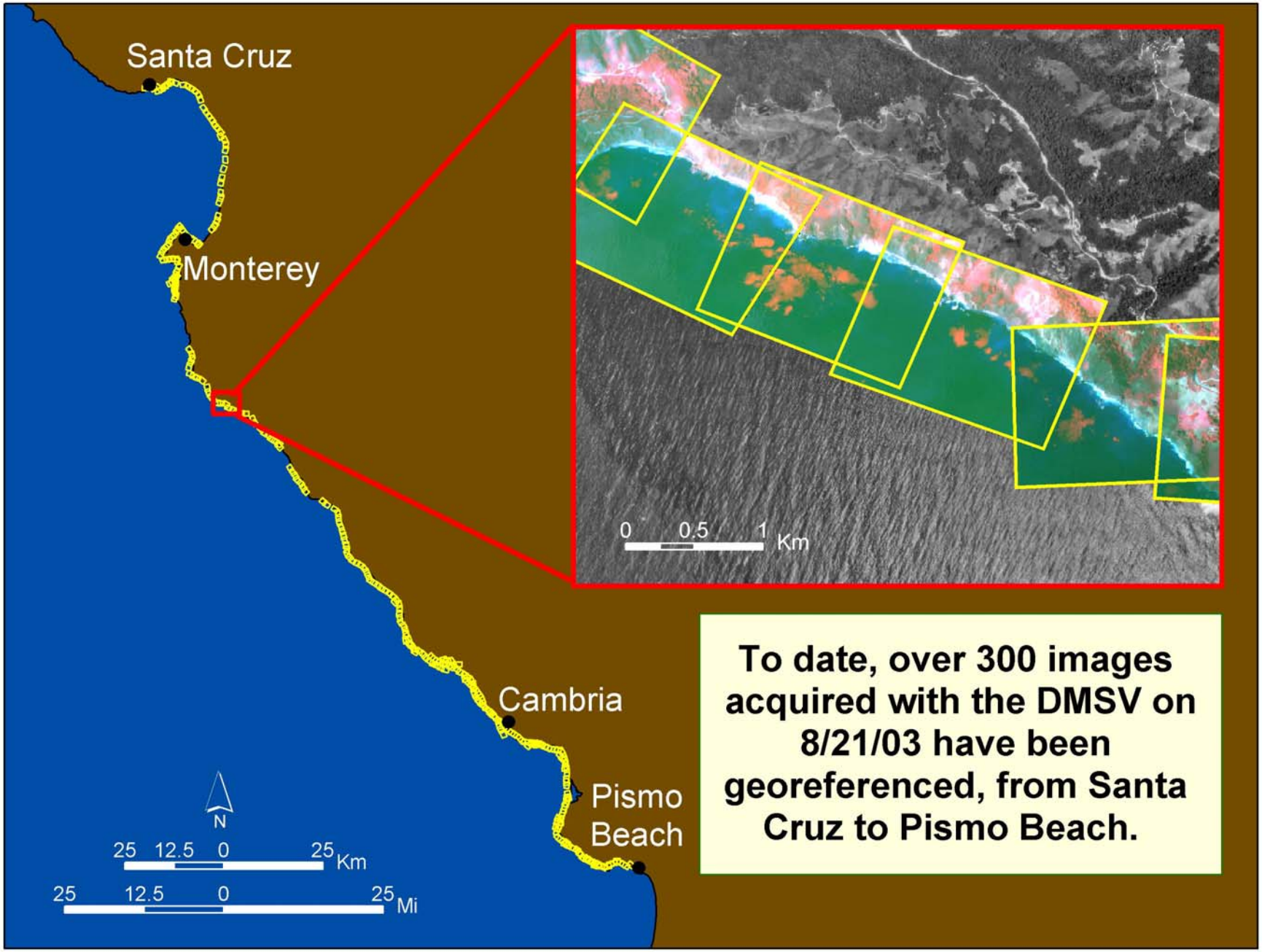

# Stillwater Cove Dive Site 4Oct02




# Lucas Pt. Kelp DMSV 4Oct02




Soquel Pt.  Kelp  4Oct02
(classified IR image+true color)


Santa Cruz
Monterey
Cambria
Pismo Beach
0 0.5 1 Km
N
25 12.5 0 25 Km
25 12.5 0 25 Mi
To date, over 300 images acquired with the DMSV on 8/21/03 have been georeferenced, from Santa Cruz to Pismo Beach.

- **Kelp Mapping** : Digital Multi-Spectral Video

- **Incident Response :** Digital-Still Imaging with Integrated GPS

  Georeferencing

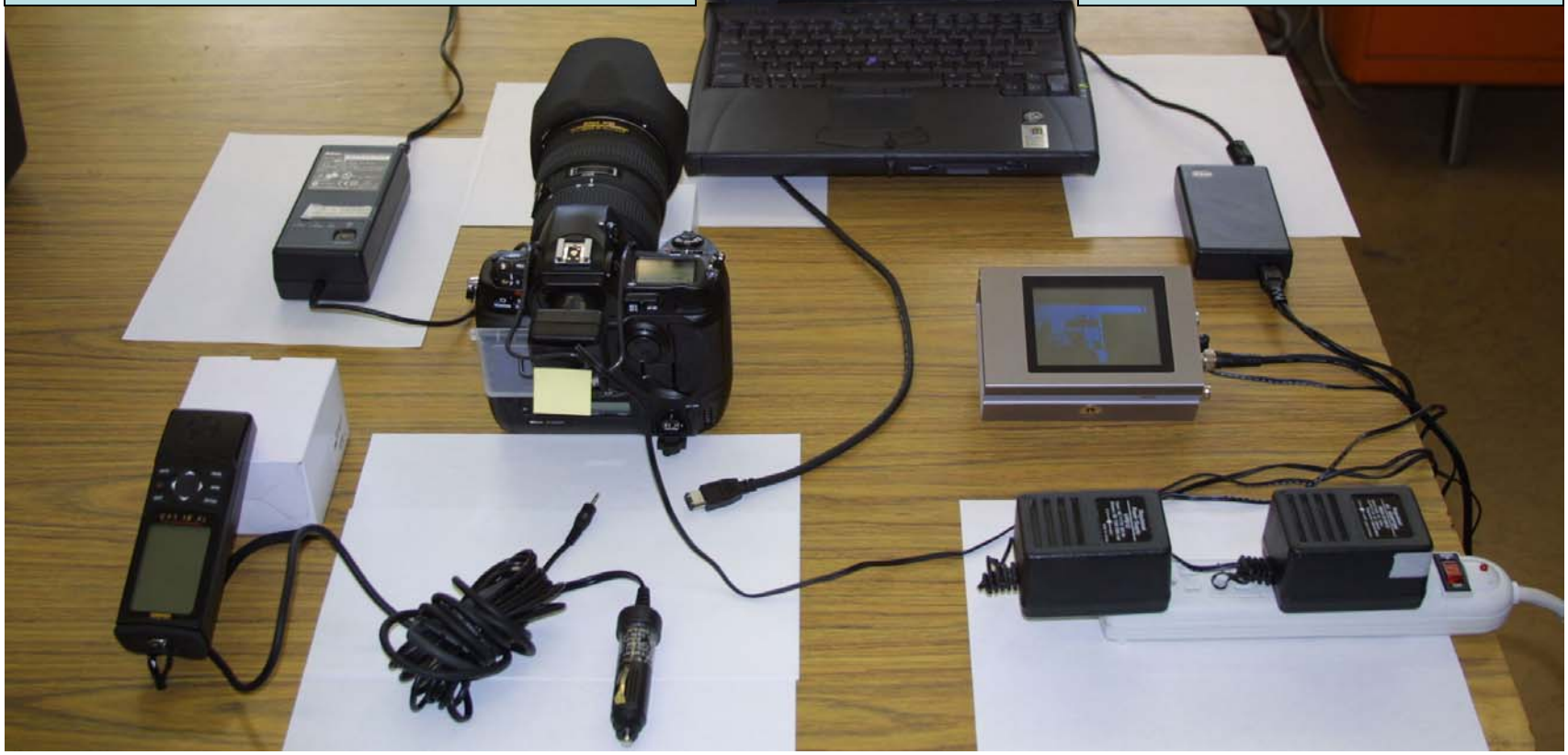
- **Code Enforcement :** Change Detection

- **Response Planning**: Video / GPS Recon

# Digital-Still Imaging -- GPS Integration

Commercial
Off-the-Shelf
Components

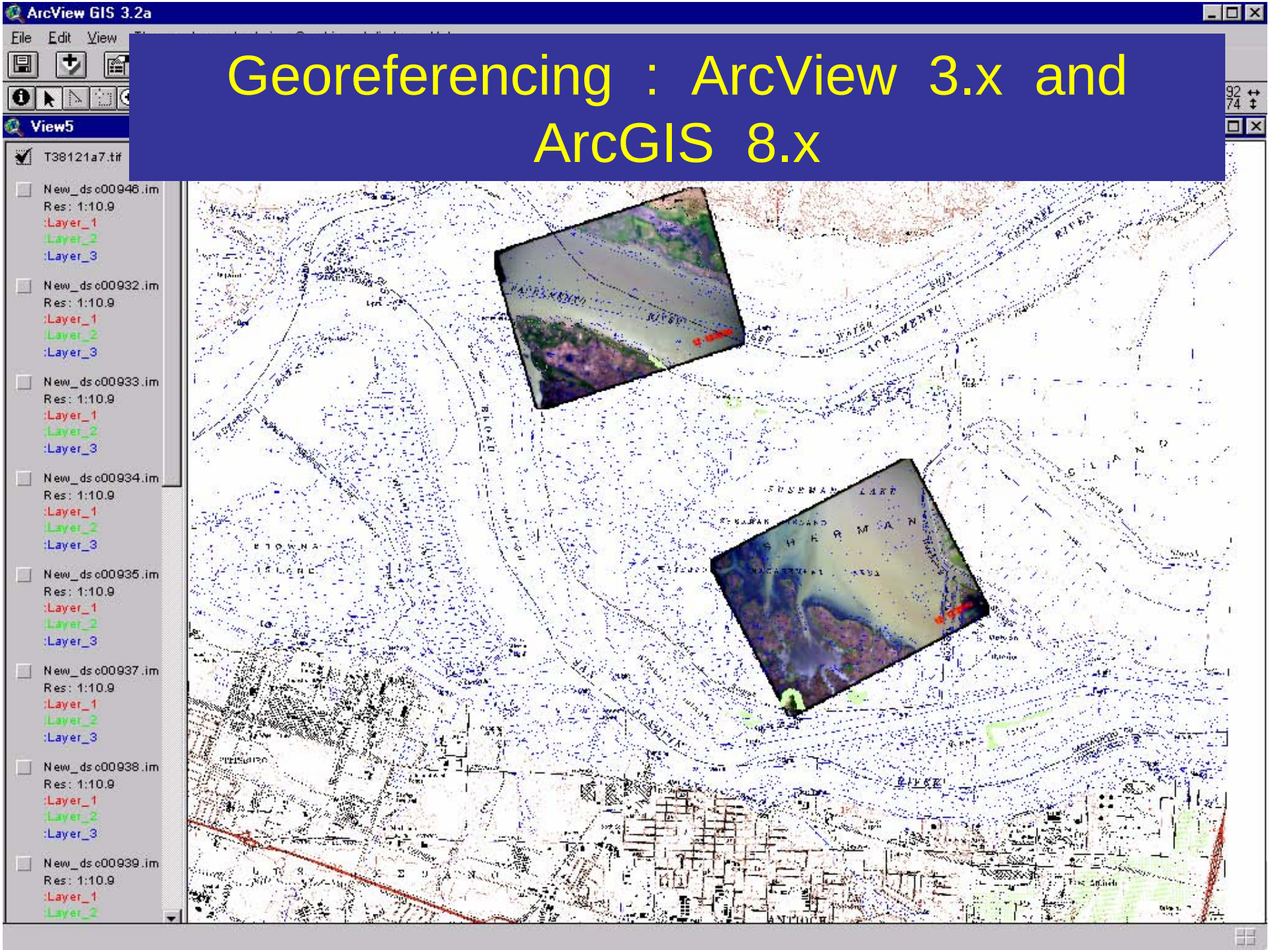
- Digital Still Camera
- Video Viewfinder
- GPS Receiver
- Laptop Computer



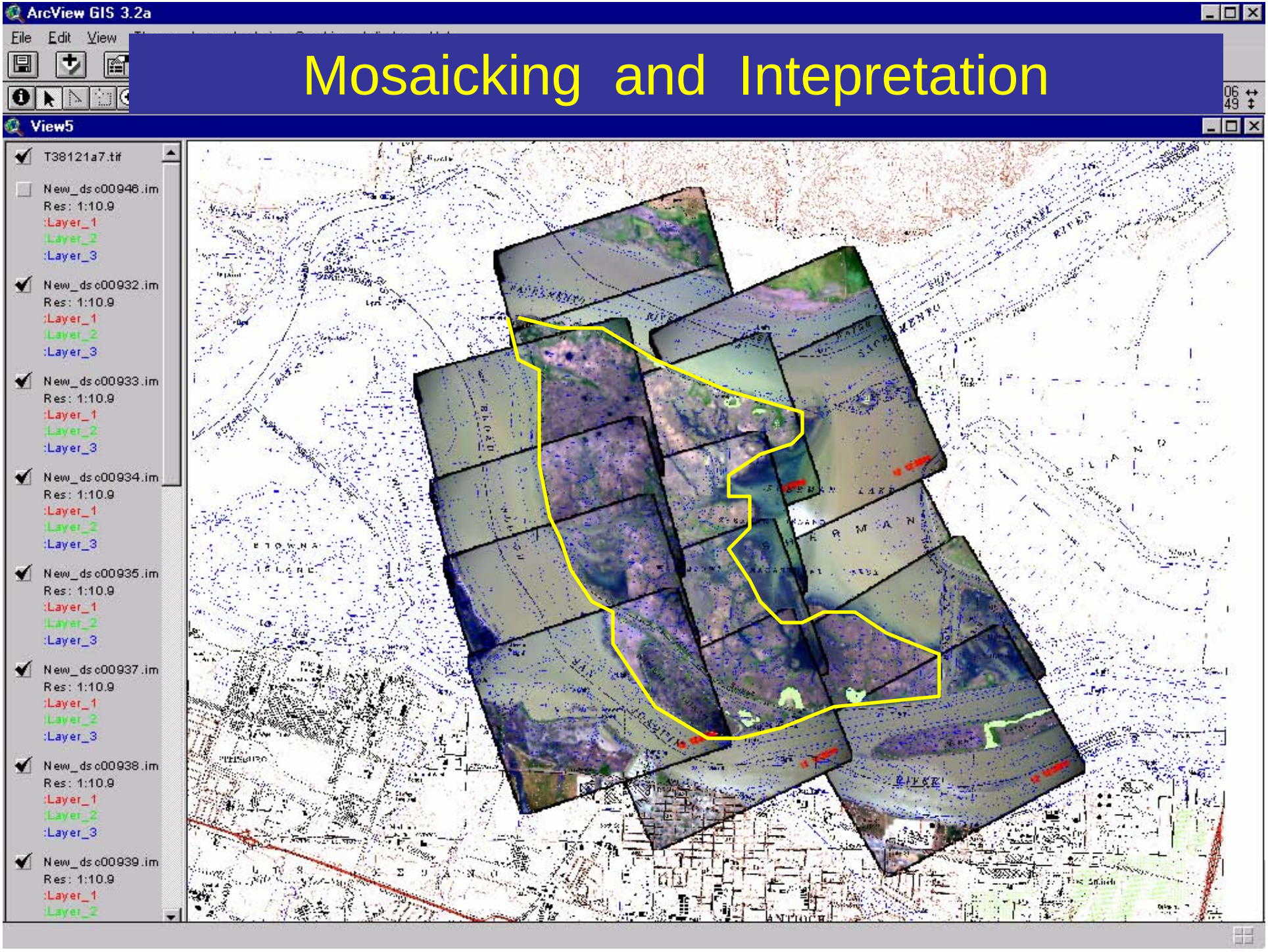
# Image with GPS and “Shooting Data” Imbedded (JPG / EXIF 2.2)


# Multiple GPS Units: Navigation and Flight Track Recording

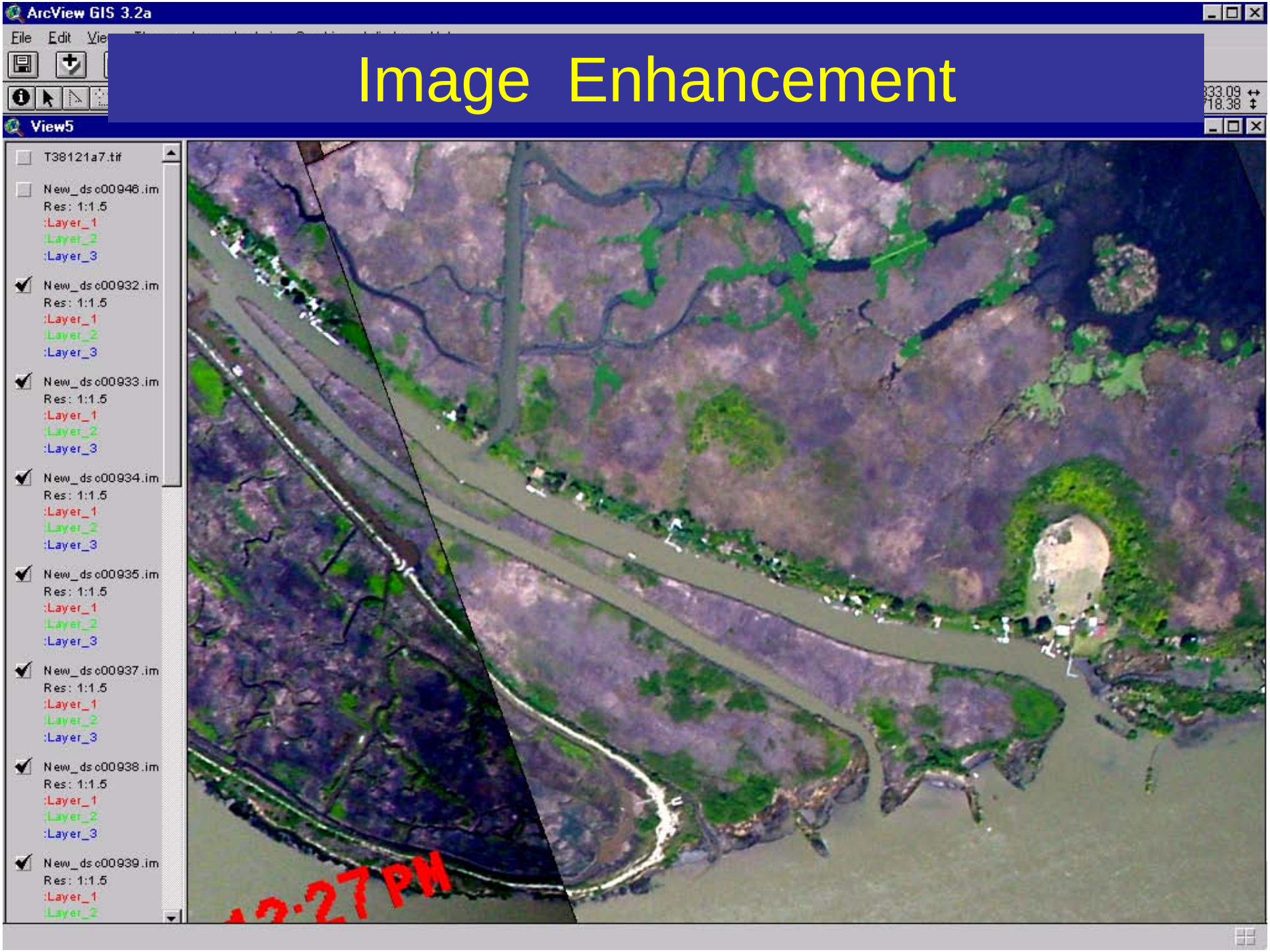
# Georeferencing : ArcView 3.x and ArcGIS 8.x



# Mosaicking and Intepretation



# Image Enhancement



- **Kelp Mapping** : Digital Multi-Spectral Video

- **Incident Response :** Digital-Still Imaging
  with Integrated GPS

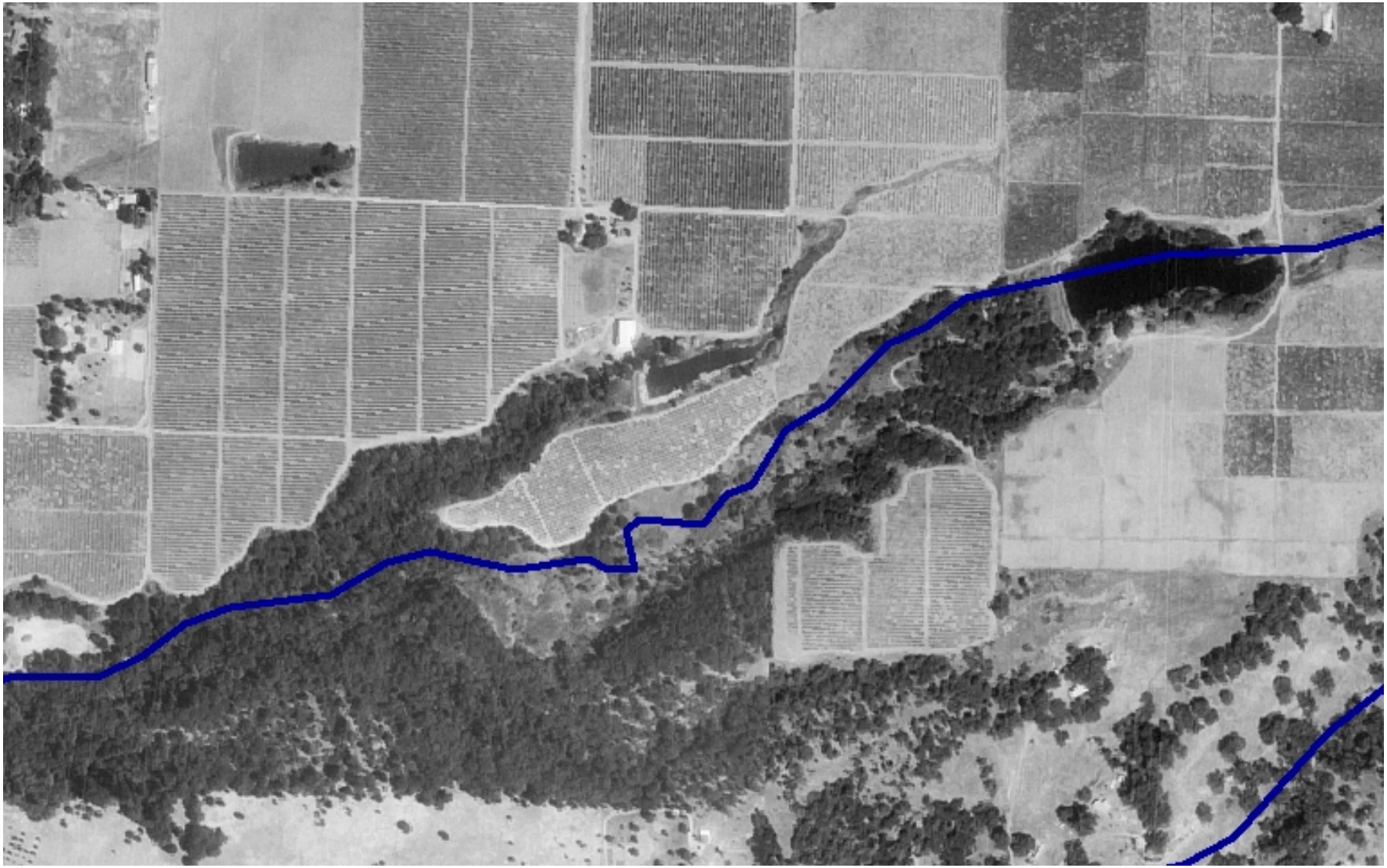
  Georeferencing

- **Code Enforcement :** Change Detection

- **Response Planning**: Video / GPS Recon

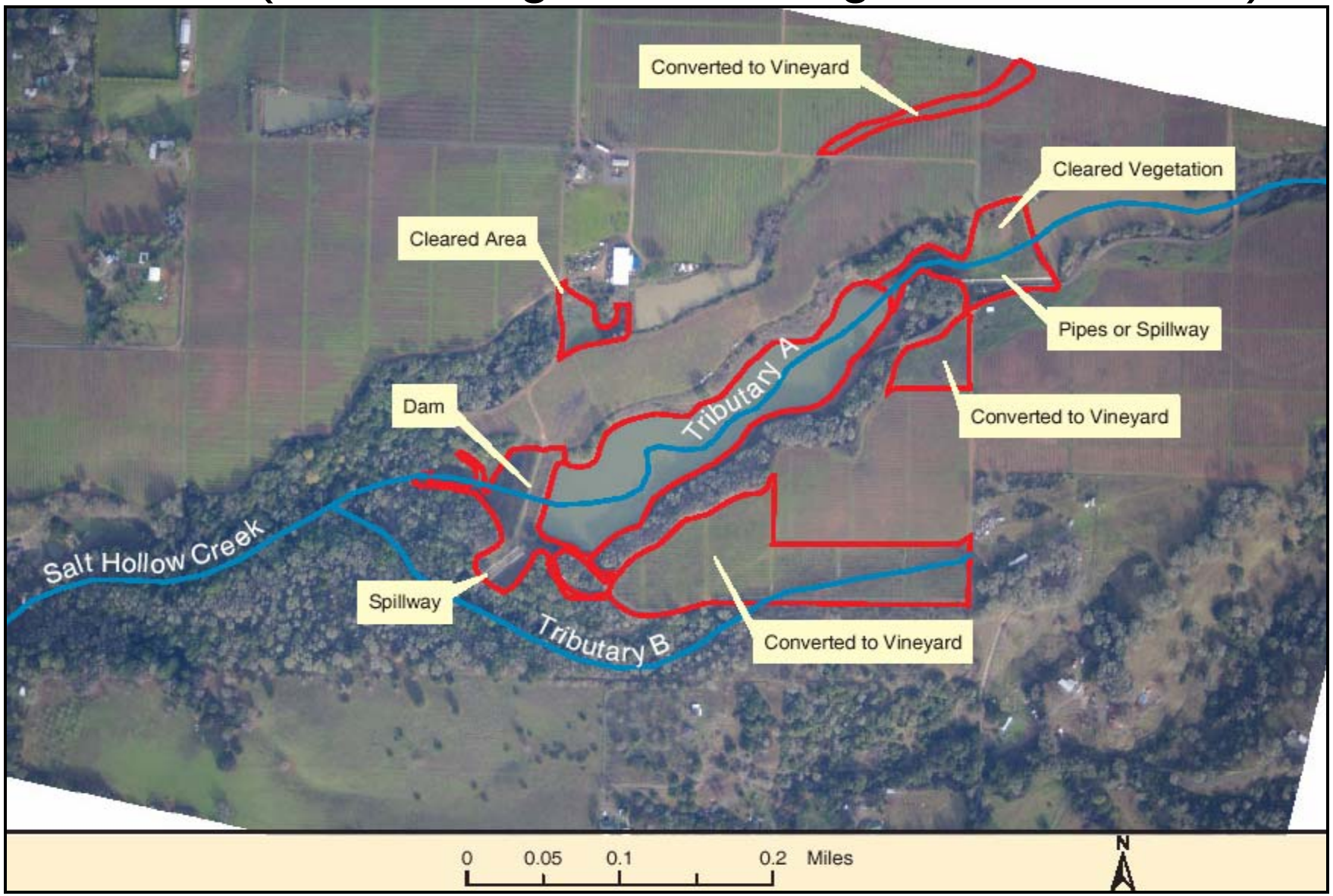
# Change Detection -- Stream Alteration

**Time 1** (USGS DOQ)



# Change Detection -- Stream Alteration

## **Time 2** (OSPR Digital Still Image, 3008 x 1960)



- **Kelp Mapping** : Digital Multi-Spectral Video

- **Incident Response :** Digital-Still Imaging
  with Integrated GPS

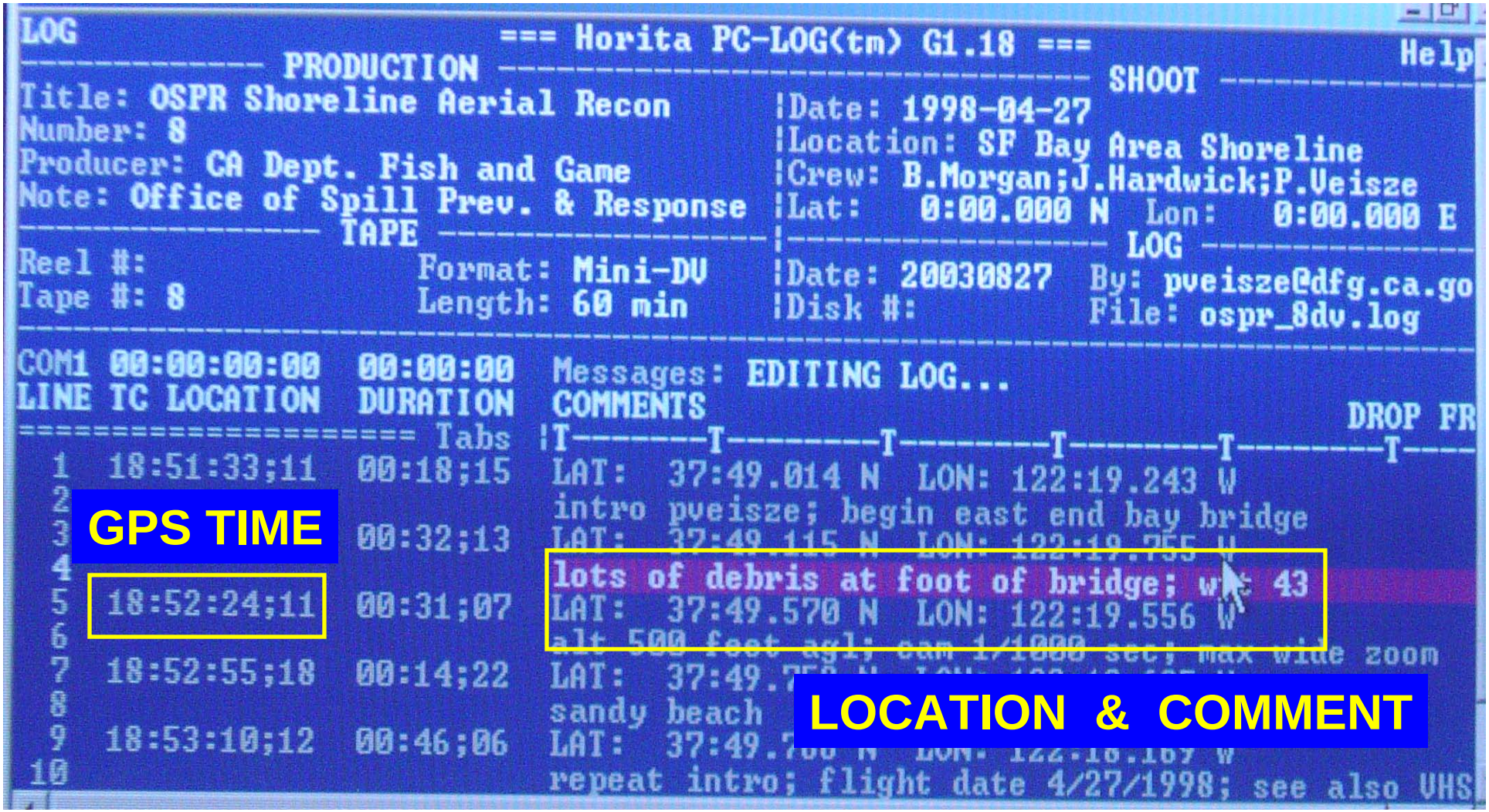
  Georeferencing

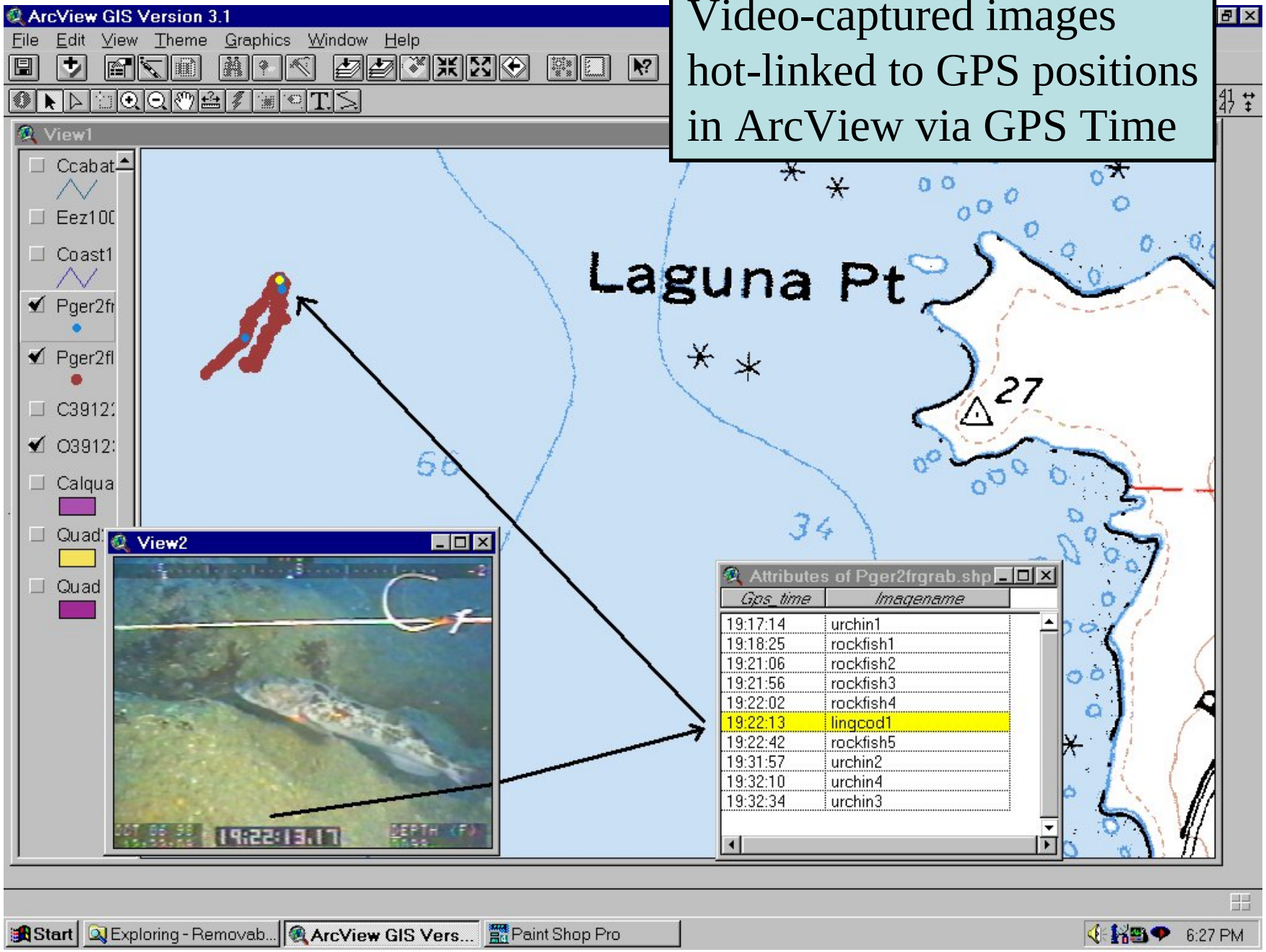
- **Code Enforcement :** Change Detection

- **Response Planning**: Video / GPS Recon

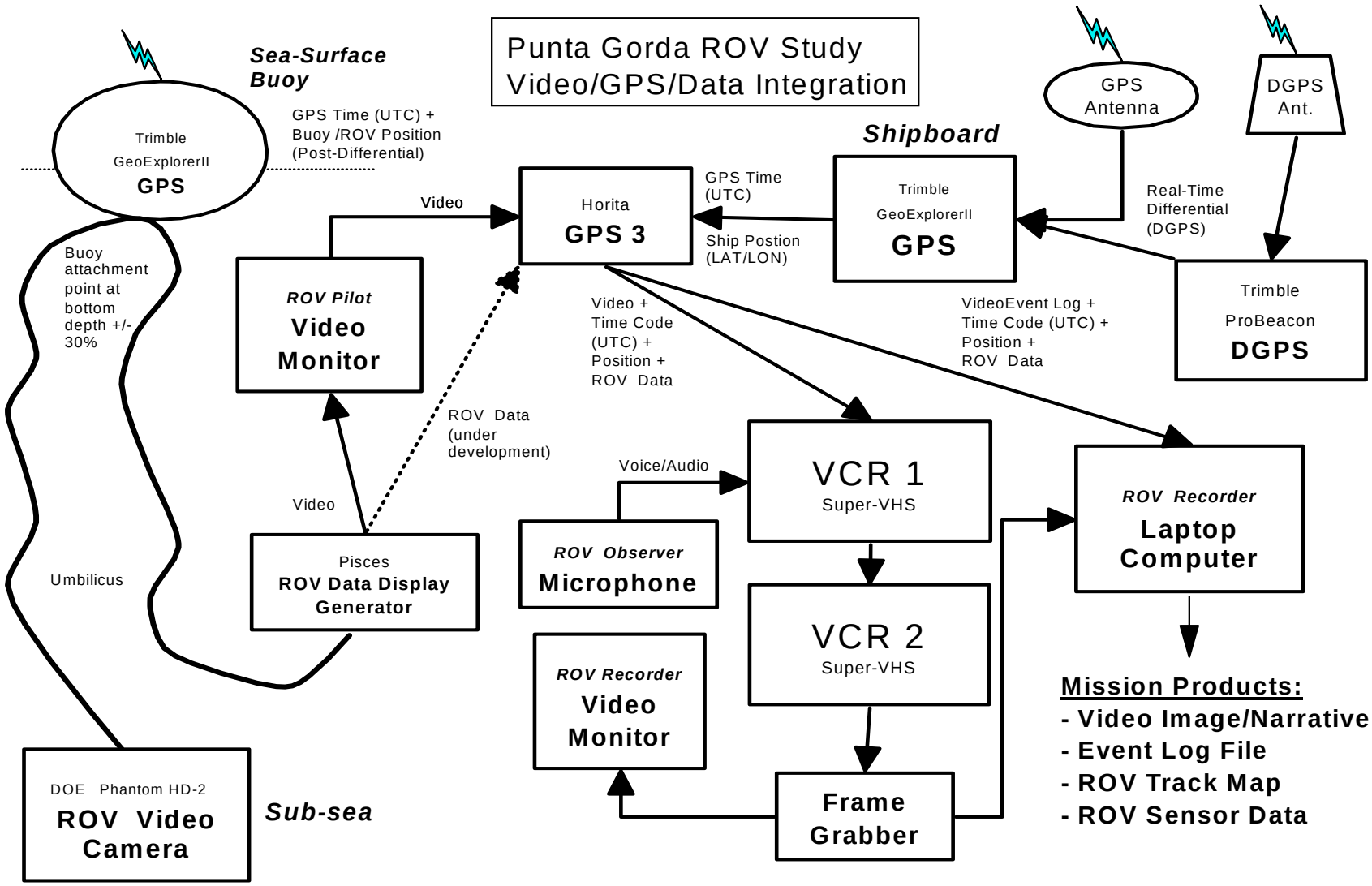
# GPS-Time Encoded Video

# Video Event Log / Time Index




Video-captured images hot-linked to GPS positions in ArcView via GPS Time
ArcView GIS Version 3.1
File Edit View Theme Graphics Window Help
View1
Laguna Pt
View2
Attributes of Pger2frgrab.shp
Gps_time Imagename
19:17:14 urchin1
19:18:25 rockfish1
19:21:06 rockfish2
19:21:56 rockfish3
19:22:02 rockfish4
19:22:13 lingcod1
19:22:42 rockfish5
19:31:57 urchin2
19:32:10 urchin4
19:32:34 urchin3
Start
Exploring - Removab...
ArcView GIS Vers...
Paint Shop Pro
6:27 PM

# GPS/Imaging Technology Transfer – Airborne / Seaborne




Version 1.0 19981014pv

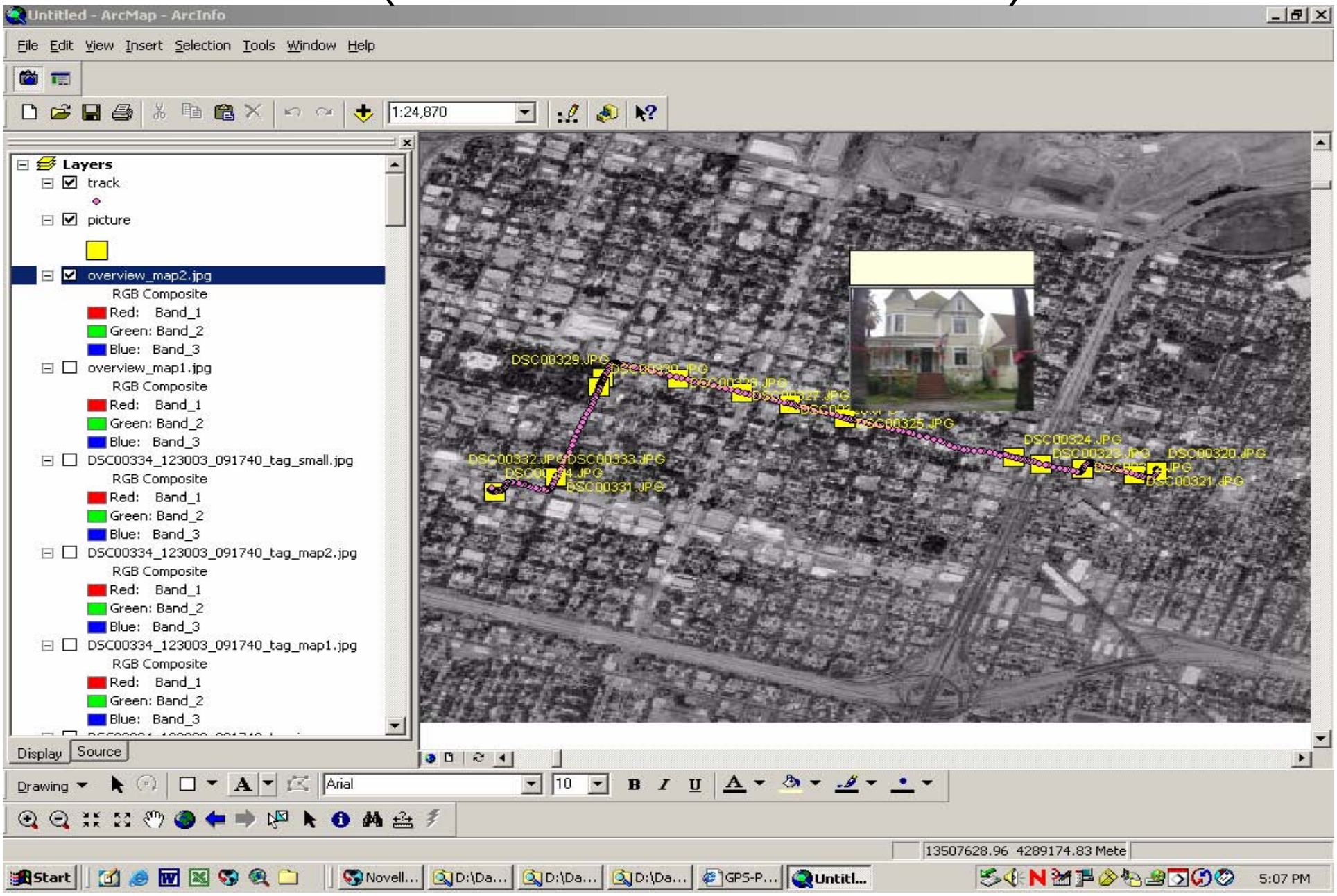
# Conclusions

- GPS Integration provides Unique Identifiers for all observations
- GPS Integration provides tightly coupled positions to all observations
- GIS and Imaging technologies enable mapping and integration of key knowledge for Incident assessment and response

# Future Developments

- Wireless connectivity – Field Data (ESRI ArcPad)
- GPS / Imaging / GIS Web Services (ESRI ArcGIS / GPS-Photo Link)
- Electronic Map & Metadata Publication (ESRI ArcIMS, ArcPublisher/ArcReader)

# GPS / Imaging / GIS Web Services Integration
# (ESRI ArcGIS / GPS-Photo Link)



# Acknowledgements


- DFG Air Services Branch
- DFG Marine Region ROV Team - GIS Lab
- DFG Information Technology Branch

  GIS Service Center
- DFG Office of Spill Prevention and Response GIS Unit

# Contact Author


- Paul Veisze
  CA Dept. Fish and Game GIS

  (916) 323 – 1667

  pveisze@dfg.ca.gov


The mission of the California Department of Fish and Game is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public.